Geza Dienes
Andrew Corporation (ONT-E)
9269 Utica, Suite 125
Rancho Cucamonga, CA 91730

Barry Lambergman, Esquire
Motorola, Inc.
1350 I Street, N.W., Suite 400
Washington, D.C. 20005

Meg Charles, Esquire
Swidler & Berlin
3000 K Street, N.W. - Suite 300
Washington, D.C. 20007

Mr. David Struba
Chief, Spectrum Management
NASA Headquarters
Code OI
Washington, D.C. 20546-0001

Richard Compton
Avoca Laboratories, Inc.
330 Siena Drive
Ithaca, NY 14850

Wayne A. Whyte, Jr.
Deputy Chief
Communications Systems Branch
Lewis Research Center
21000 Brookpark Road, MS 54-2
Cleveland, OH 44135

Brian D. Oliver
Vice President - Corporate Development
Bell Atlantic Corporation
1310 North Courthouse Road
11th Floor
Arlington, VA 22201

Chandan Banerjee
NYNEX Science and Technology
500 Westchester Avenue
White Plains, NY 10604

Ronald J. Lepkowski
Constellation Communications, Inc.
10530 Rosehaven Street
Suite 410
Fairfax, Virginia 22030

Willi Bokenkamp, Senior
Communications Analyst
Office of the President
University of California
300 Lakeside Drive
Oakland, CA 94612-3550

Robert A. Mazer, Esquire
Nixon Hargrave, Devans & Doyle
One Thomas Circle, N.W., Suite 800
Washington, D.C. 20005

Shant Hovnanian
505 Park Avenue, 21st Floor
New York, NY 10022

Douglas G. Lockie
Founder and Executive Vice-President
Endgate Technology Corporation
321 Soquel Way
Sunnyvale, CA 94086

Michael R. Gardner, Esquire
The Law Offices of Michal R.
Gardner, P.C.
1150 Connecticut Avenue, N.W.
Suite 710
Washington, D.C. 20036

Tom W. Davidson, P.C.
Akin, Gump, Strauss, Hauer
& Feld, L.L.P.
1333 New Hampshire Avenue, N.W.
Suite 400
Washington, D.C. 20036

John P. Janka, Esquire
Latham & Watkins
1001 Pennsylvania Avenue, N.W.
Washington, D.C. 20004

Gene Robinson, P.E.
Senior Fellow
Technical Director, Defense Systems
& Electronics Group
Texas Instruments, Inc.
P.O. Box 405, MS 3443
Lewisville, TX 75067

Congressman Matthew J. Rinaldo
President
International CellularVision
Association
2600 Virginia Avenue, N.W.
Suite 508
Washington, D.C. 20037

Raul R. Rodriguez, Esquire
Leventhal, Senter & Lerman
2000 K Street, N.W., Suite 600
Washington, D.C. 20006

Jeffrey A. Krauss
Telecommunications and Technology
Policy
17 West Jefferson Street
Suite 106
Rockville, MD 20850

Stephen D. Baruch, Esquire
Leventhal, Senter & Lerman
2000 K Street, N.W., Suite 600
Washington, D.C. 20006

Leslie A. Taylor, Esquire
Leslie Taylor Associates
6800 Carlynn Court
Bethesda, MD 20817-4302

Steve Copold
Director of Technology Resources
UT-Pan American Campus
1201 West University Drive
Edinburg, TX 78539-2999

Eduardo L. Elizondo
Division Fellow
Martin Marietta Astro Space
P.O. Box 800
Princeton, N.J. 08543-0800

Don Franco
President, Video/Phone Systems, Inc.
1266 Main Street
Stamford, CT 06902

Mr. Charles S. Brand
President
mm-Tech, Inc.
246 Industrial Way West
Eatontown, N.J. 07724

Walter H. Sonnenfeldt, Esquire
Walter Sonnenfeldt & Assocaites
4904 Ertter Drive
Rockville, MD 20852

Edward F. Miller
Teledesic Corporation
1150 Connecticut Avenue, N.W.
Fourth Floor
Washington, D.C. 20036

Larrie Sutliff
Director, Radio Spectrum Management
Bellcore
290 West Mount Pleasant Avenue
Room 2B230
Livingston, NJ 07039

Gerald Helman
Vice-President
Policy and International Programs
Mobile Communications Holdings, Inc.
1120 - 19th Street, N.W., Suite 480
Washington, D.C. 20036

Chellestine Johnson

EX PARTE PRESENTATION

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MPT 1420

DRAFT

Performance Specification

Performance Specifications and
Frequency Assignment Criteria for
Analogue and Digital Microwave
Fixed Link Radio Equipment
Operating in the Frequency Band
27.5 - 29.5 GHz

JULY 1991

This version of the spec contains the amendments of 10/7/91.

[redacted]

Foreword

1 It is required by the Wireless Telegraphy Act, 1949 (as modified by the Post Office Act, 1969) that no radio apparatus shall be installed or used in the United Kingdom except under the authority of a licence granted by the Secretary of State. It is a condition of such a licence that the performance of the apparatus must meet certain minimum standards.

2 The minimum standards of performance are given in specifications prepared by the Radiocommunications Agency, in consultation with the relevant manufacturers and operators.

For convenience, to avoid the need to test every piece of equipment, manufacturers are invited to make representative production models of their equipment available for testing by or under the control of the Agency.

Manufacturers or their specified agents who wish to submit equipment for type approval testing should apply to:

Radiocommunications Agency
Fixed Services Section
Room 309
Waterloo Bridge House
Waterloo Road
London SE1 8UA Telephone 071.215.2099

3 The application should state when and where the tests can be carried out and should be accompanied by a description of the apparatus, including drawings and test results obtained in the manner described in the appropriate performance specification.

It should also list all type numbers that may apply to non-technical variants of the model submitted.

Radiocommunications Agency reserves the right to give separate type approval to models it considers to be technical variants and whose performance may differ as between types.

4 A charge is made for type approval testing to recover the Agency's costs incurred in performing such work. Details of current charges are available from the address above. Manufacturers are invoiced on completion of a type approval test and the type approval certificate is provided by the Agency on receipt of payment.

5 Performance specifications may be subject to amendment. Intending manufacturers should ensure they possess the latest copy of the relevant specification.

CONTENTS

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PART 1

STANDARD REQUIREMENTS

Requirements common to all equipment

CONTENTS

Page

1 GENERAL

1.1 Scope of Specification

This specification covers the minimum mandatory requirements of multi-channel digital transmitters and receivers for use on Microwave Radio Link systems in the frequency band 27.5 GHz to 29.5 GHz. Modulation techniques shall be employed which are compatible with the limits for radiated spectrum defined within this document.

Details of the minimum performance requirements of 28 GHz antennas are contained in part 3 of this Specification.

Requirements to bring the specification into line with forthcoming EEC EMC directives are under consideration.

1.2 Operating Frequencies

The equipment shall provide for the transmission and reception of emissions in the frequency band 27.5 GHz to 29.5 GHz. The precise operating frequencies shall be quoted by the Secretary of State when a licence is issued. For the purpose of type testing, the equipment may be submitted on a mutually agreed channel in the above frequency band.

1.3 Controls

Those controls which if maladjusted might increase the interfering potentialities of the equipment shall not be easily accessible.

1.4 Declarations

When submitting an item for type approval, the manufacturer shall supply the following:-

(a) i) Nominal frequency of the transmitter

ii) For non-synthesised equipment, carrier reference frequency and carrier generation formula.

(b) i) Nominal frequency of the receiver.

ii) For non-synthesised equipment, local oscillator reference frequency and local oscillator generation formula.

(c) Rated radio frequency output power at the radio frequency output port.

(d) Digital interface characteristics, eg
Traffic rate
Input/output levels
Input/output impedances

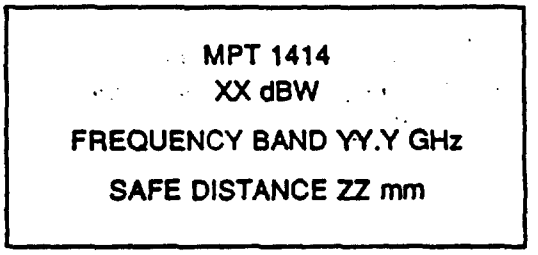
(e) Nominal supply type and voltage

1.5 Labelling

The equipment shall be provided with a clear indication of the type number and description under which it is submitted for type testing. Each number shall be unique and in the case where the testing authority finds two manufacturers have used a similar type number, one manufacturer shall be asked to change the type number.

Type approved equipment shall be permanently marked with an approved inspection mark which shall be located on the outside of the equipment and be immediately visible. The minimum dimensions of the inspection mark shall be 10 x 15 mm. The location of the inspection mark shall be agreed between the manufacturer and the testing authority and shall be recorded in the test report.

The mark used to indicate compliance shall be as shown in Figure 1.1.



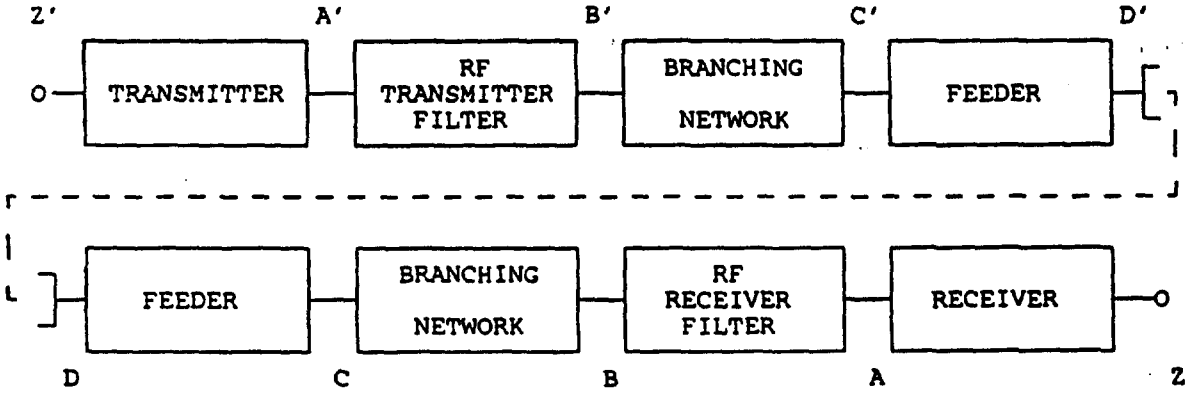
Letter & figure height shall be not less than 2 mm.

FIGURE 1.1

1.6 Input and Output Port - Definitions

1.6.1 For the purpose of the specification the terms "transmitter input port", "receiver input port", "transmitter output port" and "receiver output port" shall be taken to refer to those points corresponding respectively to the ports Z', C, C' and Z in Figure 1.2. Points Z' and Z are baseband input and output points respectively.

1.6.2 Accessibility for measuring R.F. power is referred to in Section 2.1.



Note:For the purpose of defining the measurement points, the branching network does not include a hybrid.

FIGURE 1.2 RF BLOCK DIAGRAM

2 TEST CONDITIONS: ATMOSPHERIC CONDITIONS AND POWER SUPPLIES

2.1 General

Type approval tests shall be made under normal test conditions (Section 2.3) and also, where stated, under extreme test conditions (Section 2.4).

Where the equipment is intended to be part of an integral radio equipment and antenna configuration, the radio equipment submitted for the test shall be identical to that employed in the integral arrangement except that it is separated from the antenna and fitted with a suitable waveguide flange or connector to form a test interface. Connection to this test interface will allow equipment performance to be measured.

Alternative measurement methods for the testing of integral equipment without separating the radio equipment from the antenna may be proposed. Full details of the method and limits together with supporting technical evidence shall be given in writing to the type approval authority at least four weeks prior to the tests. The use of such methods and limits are subject to the agreement of the type approval authority.

2.2 Test Power Source

During type approval tests, the power supply for the equipment may be replaced by a test power source, capable of producing normal and extreme test voltages as specified in Clauses 2.3.2 and 2.4.2.

The internal impedance of the test power source shall be low enough for its effects on the test results to be negligible. For the purpose of type approval tests, the supply voltage shall be measured at the input terminals of the equipment. If the equipment is provided with a permanently connected power cable, the test voltage shall be measured at the point of connection of the power cable to the equipment.

During the tests the power source voltage shall be maintained within a tolerance of ±3% relative to the voltage at the beginning of each test. In equipment in which batteries are incorporated, the test power source shall be applied as close to the battery terminals as practicable.

2.3 Normal Temperature Conditions

2.3.1 Normal Temperature and Humidity

The normal temperature and humidity conditions for tests shall be any convenient and naturally occurring combination of temperature and humidity within the ranges:-

Temperature +15°C to 35°C
Rel. Humidity 20% to 75%

Note: When it is impracticable to carry out the tests under the conditions stated above, a note stating the actual temperature and relative humidity during the tests shall be added to the test report.

2.3.2 Normal Test Source Voltage

2.3.2.1 Mains Voltage

The normal test source voltage for equipment to be connected to the mains shall be the nominal voltage. For the purpose of this specification the nominal voltage shall be any of the declared voltages for which the equipment is designed. The frequency of the test source corresponding to the AC mains shall be between 49 and 51 Hz.

2.3.2.2 Float Battery Power Sources

When the radio equipment is intended for operation from a float battery, the normal test source voltage shall be the typical float voltage of the battery.

2.3.2.3 Other Power Sources

For operation from other power sources or types of battery, either primary or secondary, the normal test source voltage shall be that declared by the manufacturer.

2.4 Extreme test conditions

2.4.1 Extreme temperature and humidity

For test purposes the equipment shall be required to meet the relevant environmental conditions set below:

a) Indoor equipment

Temperature	+5°C to +40°C
Relative humidity	5% to 85%

b) Outdoor equipment

Temperature	-20°C to +40°C
Relative humidity	5% to 90%

N.B. The conditions laid down in Clause 2.4 do not apply to antennas.

2.4.2 Extreme Test Source Voltages

2.4.2.1 Mains Voltage

The extreme test source voltages for equipment to be connected to an AC main source shall be the nominal mains voltage ±10%. The frequency of the test source shall be between 49 and 51 Hz.

2.4.2.2 Battery Power Sources

When the equipment is intended for operation from the usual type of regulated lead-acid battery the extreme test voltage shall be 1.3 and 0.9 times the nominal voltage of the battery specified for the equipment.

2.5 Procedure for Tests at Extreme Temperatures

2.5.1 General

Before making measurements, the equipment shall be placed in a temperature controlled chamber for a period of one hour or for such a period as may be judged necessary for thermal balance to be obtained. The equipment shall be switched off during the temperature stabilisation period. During these tests at extreme temperatures the humidity content in the test chamber shall be controlled so that it lies within the ranges given in clause 2.4.1.

2.5.2 Test Procedure

For tests at the upper temperature, after thermal balance has been attained (Clause 2.5.1), the equipment shall be switched on in the transmit condition for half an hour, after which the appropriate tests shall be carried out.

For tests at the lower temperatures, after thermal balance has been attained (Clause 2.5.1) the equipment shall be switched on in the receive or transmit condition for 30 minutes, after which the appropriate tests shall be carried out.

3 CABINET RADIATIONS

3.1 Definition

Cabinet radiations are emissions at any frequency, other than those of the carrier and associated sidebands, radiated from the cabinet structure of the equipment.

3.2 Specification Limits

Cabinet radiations shall be minimised in order to avoid interference to other radio installations. In the event of interference being traced to cabinet radiations the licensees will be required to provide interference suppression to a degree which shall be satisfactory to the Secretary of State.

4 INTERPRETATION OF THIS SPECIFICATION

In the event of doubt arising over the interpretation of this specification, or the method of conducting the tests, the decision of the Testing Authority shall be final.

5 Accuracy of Measurement

The tolerance for measurement of the quantities shown below will be as indicated.

5.1	DC Voltage	±3%
5.2	AC Mains Voltage	±3%
5.3	AC Mains Frequency	±0.5%
5.4	Radio Frequency	±100 kHz
5.5	Radio Frequency Power	±1 dB
5.6	Return Loss	±1 dB
5.7	Attenuation of Attenuators	±1 dB
5.8	Temperature	±1°C
5.9	Humidity	±5%
5.10	BER	20% accuracy 95% confidence level

MPT 1420

PART 2

PERFORMANCE SPECIFICATION

Private Fixed Link Radio Equipment with Digital Modulation

up to 155 Mbit/s for use in the Frequency Band

27.5 GHz to 29.5 GHz

CONTENTS

1 General Conditions

1.1 Arrangements for Test Signals Applied to the Receiver Input

Sources of test signals for application to the receiver input shall be connected in such a way that the return loss presented to the receiver input is not less than 23 dB.

This requirement shall be met irrespective of whether one or more signals are applied to the receiver simultaneously.

The levels of the test signals shall be expressed in terms of the power in dBW incident at the receiver input port.

The effect of any intermodulation products of noise produced in the test equipment shall have a negligible effect.

1.2 Standard Test Signal

(a) The standard test signal shall be a modulated radio frequency carrier having the same phase and amplitude transition shapes as the associated transmitter. The modulating data stream shall be encoded and/or scrambled to suit the receiver's processing. The modulating data stream shall be a pseudo random bit stream of repetition length and generator polynomial as shown in Table 2.1.

Table 2.1

Bit Rate	Repetition Length	Polynomial
2 Mbit/s	$2^{15} - 1$ Bits	$D^{15} + D^{14} + 1 = 0$
2 x 2 Mbit/s	$2^{15} - 1$ Bits	$D^{15} + D^{14} + 1 = 0$
8 Mbit/s	$2^{15} - 1$ Bits	$D^{15} + D^{14} + 1 = 0$
2 x 8 Mbit/s	$2^{15} - 1$ Bits	$D^{15} + D^{14} + 1 = 0$
34 Mbit/s	$2^{23} - 1$ Bits	$D^{23} + D^{18} + 1 = 0$
140/155 Mbit/s	$2^{23} - 1$ Bits	$D^{23} + D^{18} + 1 = 0$

(b) If the transmitter and receiver in the equipment under test operate on the same radio frequency, the transmitter modulated in accordance with Clause 1.2(a) and with its output suitably attenuated, may be used to constitute the 'wanted' signal for the purpose of receiver selectivity measurement (Section 3.3).

1.3 Receiver Mute or Squelch Facility

If the receiver is equipped with a mute or squelch circuit, this shall be made inoperative for the duration of the type approval test.

1.4 Transmitter Artificial Load

Tests on the transmitter shall be carried out using a non-reactive non-radiating load connected to the transmitter radio frequency output port. The load shall have a return loss of not less than 23 dB.

2 TRANSMITTER

2.1 Frequency Error

2.1.1 Definition

The frequency error of the transmitter is the difference between the measured carrier frequency and its nominal value.

2.1.2 Method of Measurement

(a) The transmitter shall be operated in accordance with the manufacturer's instructions and its output shall be connected to an artificial load (Section 1.4).

(b) The emission shall be monitored by a frequency counter and the carrier frequency shall be measured in the absence of modulation.

(c) The measurement shall be made under normal test conditions (Part 1 Section 2.3) and repeated under extreme conditions (Part 1 Clauses 2.4.1 and 2.4.2 applied simultaneously).

2.1.3 Limits

The frequency error, under both normal and extreme test conditions shall not exceed ± 10 ppm.

2.2 Carrier Power

The maximum value of the effective radiated power of the carrier in an operating system will be a condition of the licence. Compliance with this requirement shall be achieved by a combination of the power range of the equipment and the antenna used.

2.2.1 Definition

The carrier power of a transmitter is the average power supplied to the antenna transmission line by a transmitter during one radio frequency cycle taken under conditions of no modulation. (CW conditions).

2.2.2 Method of Measurement

(a) The transmitter output port shall be connected to an artificial load (Section 1.4) with means of measuring the power delivered to this load.

(b) In absence of modulation (ie CW conditions), the transmitter shall be operated in accordance with the manufacturer's instructions.

(c) The measurement shall be made under normal test conditions (Part 1 Section 2.3) and repeated under extreme test conditions (Part 1 Clauses 2.4.1 and 2.4.2 applied simultaneously).

2.2.3 Limits

The carrier output power under all test conditions shall be within ± 3 dB of the rated output power declared in Part 1 Sub-Clause 1.4(c). The maximum output power shall not exceed 0 dBW under any conditions.

2.3 Spurious Emissions

2.3.1 Definition

Spurious emissions are emissions at frequencies which are outside the Necessary Bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude emissions on frequencies immediately outside the Necessary Bandwidth which result from the modulation process. The Necessary Bandwidth is defined as twice the transmitted symbol rate.

2.3.2 Method of Measurement

(a) The transmitter output port shall be connected to either a spectrum analyzer via an attenuator, or an artificial load with some means of monitoring the emission with a spectrum analyzer or selective voltmeter.

(b) The transmitter shall be unmodulated, (ie CW conditions). At each spurious emission from 70 MHz to 60 GHz, excluding frequencies within the Necessary Bandwidth about the carrier frequency, the level of the emission shall be measured relative to the level of the carrier emission.

(c) The power level of each emission shall be calculated by applying the ratio measured in Clause 2.3.2(b) to the carrier power determined in Section 2.2 under normal test conditions.

2.3.3 Limits

The power of any spurious emission measured in Clauses 2.3.2(b) & (c) shall not exceed:

70 MHz to 21.2 GHz	:	-90 dBW
21.2 GHz to 60 GHz	:	-60 dBW

2.4 Radiated Spectrum

2.4.1 Method of Measurement